DETAILED ACTION

Claim Objections

1. Claims 8, 16, 17 and 18 are objected to because of the following informalities:

Claim 8 (line 2), claim 16 (line 1), claim 17 (line 1), claim 18 (line 1): -- "CO_2"-- should be replaced by -- "CO" -- (See Specifications: page 7, lines 14-16)

Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 11, 22-24 and 29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 11 (line 3), claim 22 (lines 2 and 3), claim 23 (lines 2 and 3) recite, "employing particular compact process unit design". Claims 24 (line 2) and 29 (line 2) recite "compact gas reforming". The specification does not provide a full, clear, concise, and exact description of "compact gas reforming" and "particular compact process unit design".

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1, 2, 4, 5, 13, 15-18, and 29 are rejected under 35 U.S.C. 103(a) as obvious over Olsvik et al (WO 00/18680).

8. With respect to claim 1, Olsvik discloses a process for production and upgrading of heavy and extra-heavy crude oil (See page 8, lines 29-32; page 9, line 1). The process comprises:

(a) Reforming of hydrocarbons to produce gases comprised of hydrogen, CO_2, and steam (See page 2, lines 21-26);

(b) Separating the gases to give a hydrogen-rich fraction and a CO_2-rich fraction and steam (See page 2, lines 27-28; page 4, line 10);

(c) Injecting the CO_2-rich fraction into a reservoir containing one of heavy or extra-heavy oil to increase the oil recovery (See page 3, lines 11-12; page 8, lines 29-32; page 9, line 1); and

(d) Hydrogenation of the heavy or extra-heavy oil to finished products (See page 3, lines 13-14; page 18, line 7).

Olsvik invention does not specifically disclose injecting steam in step (c). However, it is to be noted that steam reforming produces steam as a by-product (See figure 1). Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Olsvik invention and use steam along with carbon dioxide for enhanced oil recovery. Since heat is needed in the reservoir to reduce the viscosity for the heavy crude to flow easily, steam will be useful for that purpose.

Olsvik invention does not specifically disclose upgrading and refining by hydroprocessing comprising a plurality of steps of hydrocracking and hydrotreating in step (d), however the invention does disclose hydrogenation of heavy oil, which encompasses the hydrocracking and hydrotreating steps.

Alternatively, it would have been obvious to one skilled in the art at the time the invention was made to modify Olsvik invention and upgrade the heavy crude by hydrocracking and hydrotreating, because hydrocracking is known to those skilled in the art to produce lighter and more useful fractions and hydrotreating is conducted to reduce sulfur and nitrogen impurities and thus upgrade different fractions.

9. With respect to claim 2, Olsvik discloses that step (a) is steam reforming (See page 2, lines 23-24; page 5, lines 9-13).

10. With respect to claim 4, Olsvik discloses that the reforming step (a) is one of auto-thermal reforming or partial oxidation (See page 4, lines 26-30).

11. With respect to claim 5, Olsvik discloses that air is used as oxidizer in the autothermal reformer or in partial oxidation reactor (See page 3, lines 30-32).

12. With respect to claim 13, Olsvik invention does not specifically disclose using geothermal heat.

Since enhanced oil recovery requires high temperatures in the reservoir to reduce the viscosity of the heavy oil for easy recovery, it would have been obvious to one skilled in the art at the time the invention was made to modify Olsvik invention and use geothermal heat for enhanced oil recovery.

13. With respect to claim 15, Olsvik invention discloses that the hydrocarbon reformed is natural gas (See page 2, lines 23-24).

14. With respect to claims 16-18, Olsvik discloses that CO produced during the reforming process is reacted in a water gas shift reaction to produce additional CO_2 and H_2 (See page 2, lines 25-26).

15. With respect to claim 29, Olsvik discloses a compact gas reforming unit (See figure 1).

16. Claims 3, 6-8, and 14 are rejected under 35 U.S.C. 103(a) as obvious over Olsvik et al (WO 00/18680) in view of Olsvik (WO 00/18681).

17. With respect to claim 3, Olsvik ('18680) invention does not specifically disclose reforming under supercritical conditions.

Olsvik ('18681) discloses a process similar to Olsvik ('18680) for steam reforming hydrocarbons, producing H_2-rich and CO_2- rich streams, using CO_2-rich stream in

enhanced-oil-recovery, and H_2-rich stream in hydrogenation operation. Olsvik ('18681) also discloses that the reforming is performed under supercritical conditions (See abstract and page 2, lines 23-30; page 4, lines 18-22). Olsvik ('18681) further discloses that the invention involves reduced compression costs in enhanced oil recovery because CO_2-rich gas is produced at a high pressure.

Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Olsvik ('16980) invention and conduct reforming under supercritical conditions for reduced compression costs in the enhanced-oil-recovery.

18. With respect to claims 6, 7 and 14, Olsvik ('18680) discloses that an oxygen-rich gas or air/oxygen enriched air stream is added in the reforming reactor (See page 3, lines 1-3). Thus, at least a part of N_2 follows the CO_2-rich gas stream through the process (See page 3, lines 8-10). Olsvik also discloses that the reforming is done in a partial oxidation reactor (See page 3, lines 3-4). It is known to those skilled in the art that partial oxidation uses sub-stoichiometric oxygen. Thus, a substantial amount of air/oxygen is not used. Since nitrogen follows the CO_2-rich gas stream, oxygen must be available as surplus. Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Olsvik ('16980) invention and separate the remaining air to produce purified oxygen as claimed to be used in the reforming operation and make the process more efficient.

19. With respect to claim 8, Olsvik ('18680) discloses that CO produced during the reforming process is reacted in a water gas shift reaction to produce additional CO_2 and H_2 (See page 2, lines 25-26).

20. Claims 9-12 are rejected under 35 U.S.C. 103(a) as obvious over Olsvik et al (WO 00/18680) in view of Graue (US Patent 6,328,104).

21. With respect to claim 9, Olsvik ('18680) invention discloses injection of carbon dioxide and steam in the reservoir, however, the invention does not specifically disclose injection of hydrogen in the reservoir.

Graue invention discloses a process similar to Olsvik ('16680) for upgrading and recovery of heavy crude oils from subsurface formations (See abstract). Graue also discloses that the heavy oil is upgraded in the reservoir by hydrogen injection (See abstract, column 6, lines 31-34). Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Olsvik invention and inject hydrogen as disclosed by Graue along with carbon dioxide and steam in to the reservoir to produce upgraded and lighter components.

22. With respect to claims 10-12, Graue discloses that the heavy oil is upgraded in a downhole upgrading unit (See column 6, lines 36-43). Graue also discloses that the heavy oil is upgraded on an onshore facility (See figure 1 and column 12, lines 7-15). Figure 1 also shows that it is a compact process unit design. Graue further discloses

that a part of the heat needed for enhance oil recovery of heavy crude oil is generated by in-situ combustion (See column 8, lines 19-22, 54-54-57).

23. Claim 19-28 are rejected under 35 U.S.C. 103(a) as obvious over Olsvik et al (WO 00/18680) in view of Olsvik (WO 00/18681) and further in view of Graue (US Patent 6,328,104).

24. With respect to claim 19, Olsvik ('16680) invention does not specifically disclose injection of hydrogen in the reservoir.

Graue invention discloses a process similar to Olsvik ('16680) for upgrading and recovery of heavy crude oils from subsurface formations (See abstract). Graue also discloses that the heavy oil is upgraded in the reservoir by hydrogen injection (See abstract, column 6, lines 31-34). Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Olsvik invention and inject hydrogen as disclosed by Graue along with carbon dioxide and steam in to the reservoir to produce upgraded and lighter components.

25. With respect to claims 20-23, Graue discloses that the heavy oil is upgraded in a downhole upgrading unit (See column 6, lines 36-43). Graue also discloses that the heavy oil is upgraded on an onshore facility (See figure 1 and column 12, lines 7-15). Figure 1 also shows that it is a compact process unit design.

26. With respect to claim 24, Olsvik ('16680) discloses a compact gas reforming unit (See figure 1).

27. With respect to claims 25 and 27, Graue discloses that a part of the heat needed for enhance oil recovery of heavy crude oil is generated by in-situ combustion (See column 8, lines 19-22, 54-54-57).

28. With respect to claims 26 and 28, Olsvik invention does not specifically disclose using geothermal heat.

Since enhanced oil recovery requires high temperatures in the reservoir to reduce the viscosity of the heavy oil for easy recovery, it would have been obvious to one skilled in the art at the time the invention was made to modify Olsvik invention and use geothermal heat for enhanced oil recovery and easy transport of the heavy oil from the reservoir.

Conclusion

29. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Gondouin, US Patent 4,706,751.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to PREM C. SINGH whose telephone number is (571)272-6381. The examiner can normally be reached on 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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/Glenn A Caldarola/
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